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IN THE CLAIMS:

20. (Currently Amended) A method of performing an assay process, comprising the steps of:

providing microbeads in a solution;

placing the microbeads on an alignment substrate;

reading codes of the microbeads and the position thereof on the alignment substrate using a bead mapper;

reading the fluorescence on each microbead and the position order thereof on the alignment substrate using a scanner; and

determining an assay result based on bead position order and bead code of the earlier reading steps.

21. (Previously Presented) The method of claim 20, wherein the fluorescence reading step is performed before the code reading step.

22. (Withdrawn) The method of claim 20, wherein the method comprises hybridizing the microbeads with a sample in the solution.

23. (Withdrawn) The method of claim 22, wherein the hybridizing step is performed, between the providing step and placing step.

24. (Withdrawn) The method of claim 22, wherein the hybridizing step is performed between the placing step and the reading codes step.

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25. (Withdrawn) The method of claim 22 wherein the hybridization step is performed between the reading codes step and reading fluorescence step.

26. (Previously Presented) The method of claim 20, wherein the microbead is an encoded particle and comprises:

a particle substrate;

at least a portion of said substrate being made of a substantially single material and having at least one diffraction grating embedded therein, said grating having a resultant refractive index variation within said single material at a grating location; and

said grating providing an optical output signal indicative of a code when illuminated by an incident light signal propagating from outside said substrate, said optical output signal being a result of passive, non-resonant scattering from said grating when illuminated by said incident light signal.

27. (Previously Presented) The method of claim 26, wherein the refractive index variation comprises at least one refractive index pitch superimposed at a grating location.

28. (Previously Presented) The method of claim 26, wherein said refractive index variation comprises a plurality of refractive index pitches superimposed at said grating location.

29. (Previously Presented) The method of claim 26, wherein said substrate is made of a material selected from the group: glass, silica, plastic, rubber, and polymer.

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30. (Previously Presented) The method of claim 26, wherein said code comprises at least a predetermined number of digital bits, said number being: 3, 5, 7, 9, 10, 12, 14, 16, 18, 20, 24, 28, 30, 40, 50, or 100.

31. (Previously Presented) The method of claim 26, wherein said code comprises a plurality of bits, each bit having a corresponding spatial location in said optical output signal and each bit in said code having a value related to the intensity of said output optical signal at the spatial location of each bit.

32. (Previously Presented) The method of claim 26, wherein said substrate has a length that is less than a predetermined value, said value being about 30, 65, 80, 125, 250, 500, 750 or 1000 microns.

33. (Previously Presented) The method of claim 26, wherein said substrate has a diameter that is less than a predetermined value, said value being about 30, 65, 80, 125, 250, 500, 750 or 1000 microns.

34. (Previously Presented) The apparatus of claim 26, wherein at least a portion of said substrate has a 3-D shape selected from the group: a cylinder, a sphere, a cube, and a pyramid.

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35. (Previously Presented) Apparatus for reading microbeads that form part of an assay process, comprising:

an alignment substrate for receiving the microbeads thereon; and

a bead mapper for reading codes of the microbeads and the position order thereof on the alignment substrate.

36. (Previously Presented) Apparatus of claim 35, wherein the microbead is an encoded particle and comprises:

a particle substrate;

at least a portion of said substrate being made of a substantially single material and having at least one diffraction grating embedded therein, said grating having a resultant refractive index variation within said single material at a grating location; and

said grating providing an optical output signal indicative of a code when illuminated by an incident light signal propagating from outside said substrate, said optical output signal being a result of passive, non-resonant scattering from said grating when illuminated by said incident light signal.

37. (Currently Amended) The apparatus of claim ~~35~~36, wherein said refractive index variation comprises at least one refractive index pitch superimposed at said grating location.

38. (Currently Amended) The apparatus of claim ~~35~~36, wherein said refractive index variation comprises a plurality of refractive index pitches superimposed at said grating location.

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39. (Currently Amended) The apparatus of claim ~~35~~36, wherein said substrate is made of a material selected from the group: glass, silica, plastic, rubber, and polymer.

40. (Currently Amended) The apparatus of claim ~~35~~36, wherein said code comprises at least a predetermined number of digital bits, said number being: 3, 5, 7, 9, 10, 12, 14, 16, 18, 20, 24, 28, 30, 40, 50, or 100.

41. (Currently Amended) The apparatus of claim ~~35~~36, wherein said code comprises a plurality of bits, each bit having a corresponding spatial location in said optical output signal and each bit in said code having a value related to the intensity of said output optical signal at the spatial location of each bit.

42. (Currently Amended) The apparatus of claim ~~35~~36, wherein said substrate has a length that is less than a predetermined value, said value being about 30, 65, 80, 125, 250, 500, 750 or 1000 microns.

43. (Currently Amended) The apparatus of claim ~~35~~36, wherein said substrate has a diameter that is less than a predetermined value, said value being about 30, 65, 80, 125, 250, 500, 750 or 1000 microns.

44. (Currently Amended) The apparatus of claim ~~35~~36, wherein at least a portion of said substrate has a 3-D shape selected from the group: a cylinder, a sphere, a cube, and a pyramid.